

WELCOME



THE POTENTIAL OF WIRELESS ACCESS SHARING

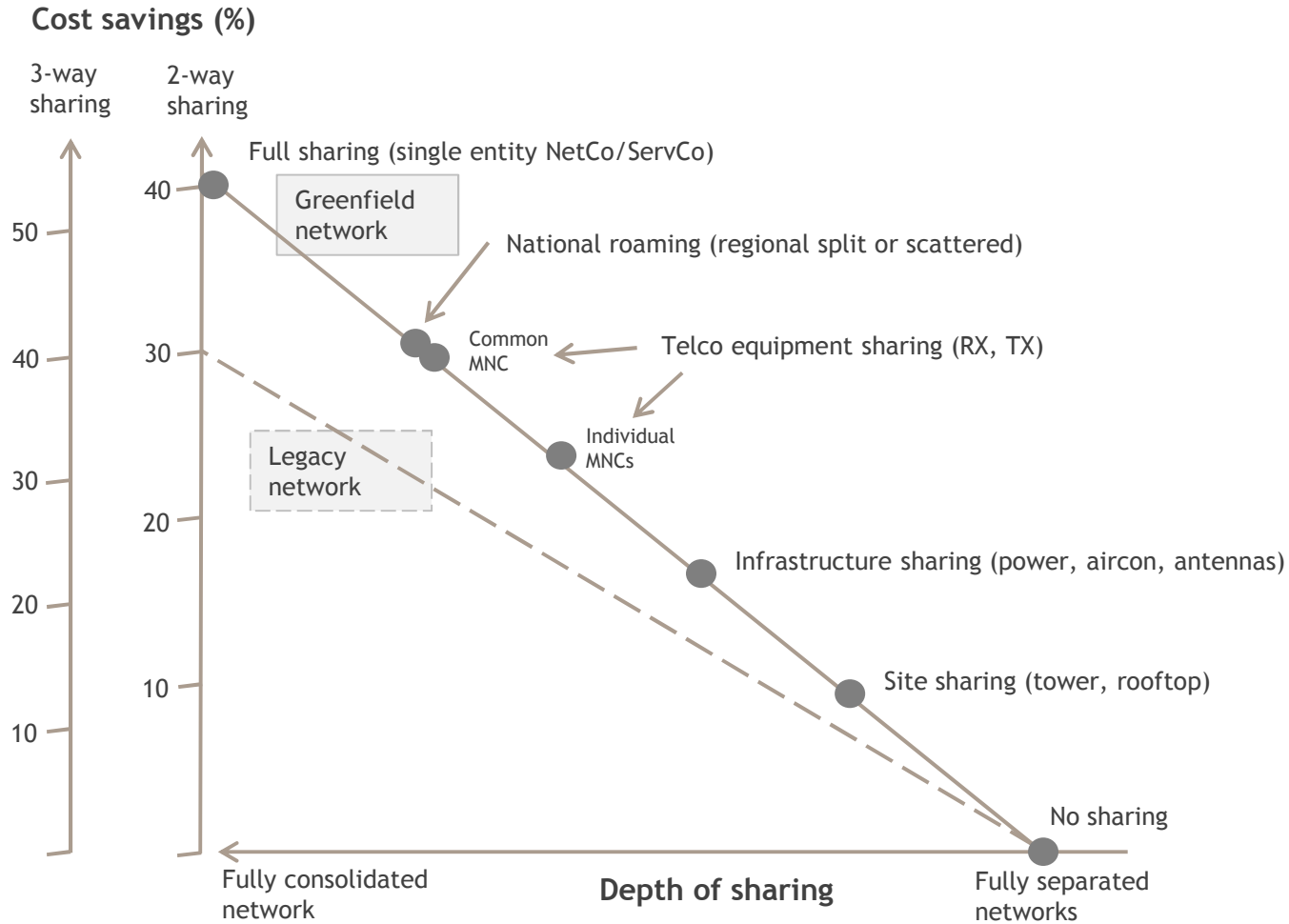
Markus Gruber, Bell Labs, Alcatel-Lucent

December 4th, 2014

..... Alcatel-Lucent



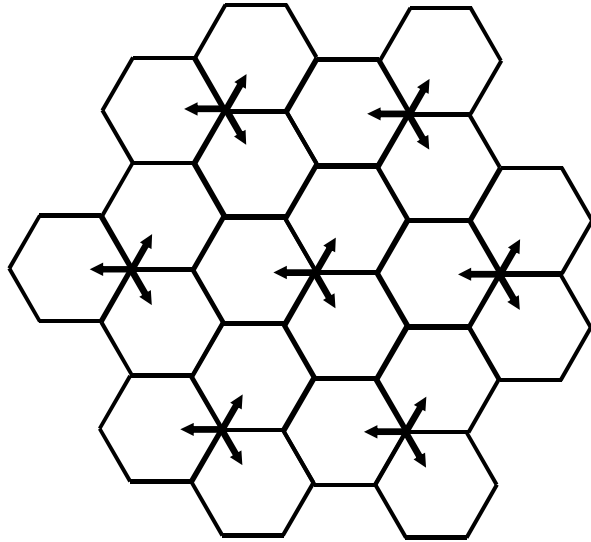
POTENTIAL COST SAVINGS OF SHARING



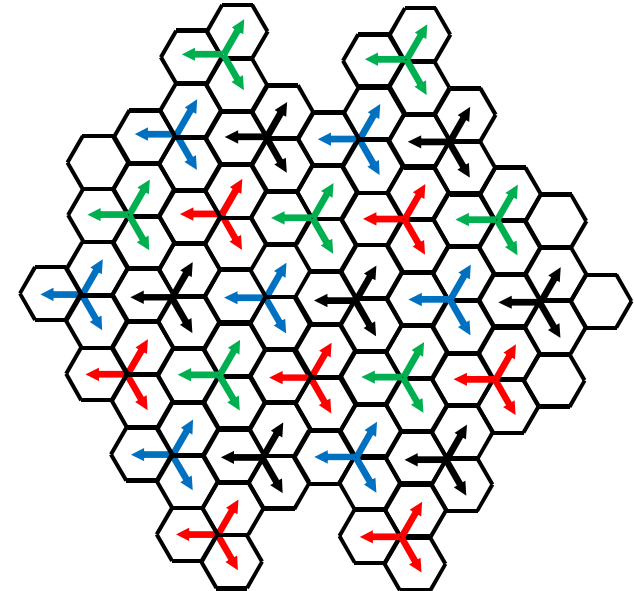
Source: Vodafone estimates of savings from network sharing, 2009, from "Joint BEREC/RSPG report on infrastructure and spectrum sharing in mobile/wireless networks", 2011

SHARING WIRELESS NETWORKS MAKES ECONOMIC SENSE

POTENTIAL ENERGY SAVINGS OF SHARING



Given:
 - Area A
 - 4 operators
 - 7 base stations per operator



← *Perfect collocation of n operators' resources*

Good: Synergy effects (hardware, backhaul)
Bad: Cell sizes remain the same
 → No transmission power is saved
Bad: No spatial reuse

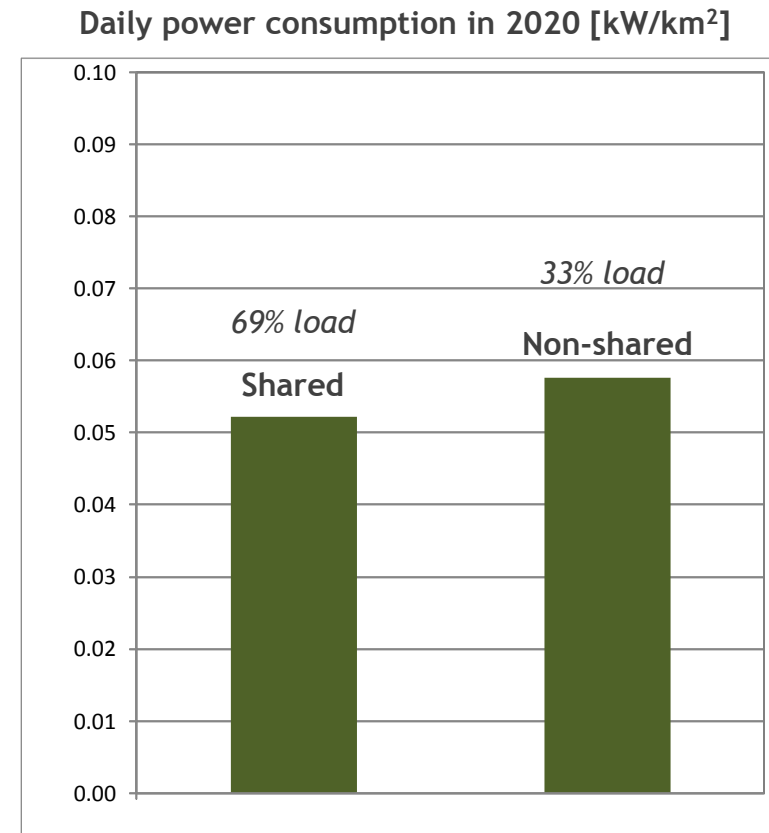
Perfect distribution of n operators' resources →

Good: Cells only have $\sqrt{1/n}$ the radius of the collocated case and thus requires only $(\sqrt{1/n})^c$ the transmission power (with c being the pathloss coefficient)
 → with 4 operators and a pathloss coefficient of 3.76 only ~7% of the transmission energy is needed
Good: n times the capacity thanks to spatial reuse
Bad: No synergy effects

COLLOCATION/DISTRIBUTION HAS IMPACT ON ENERGY SAVINGS

MINIMIZATION OF POWER - SHARED VS NON-SHARED (SUBURBAN)

- Shared: 1 wholesale operator with total traffic 4X
 - Macro: $P=46\text{dBm}$, $CF=0.8\text{ GHz}$, $BW=20\text{ MHz}$, $2\times 2\text{ MIMO}$, $ISD = 2150\text{m}$
 - Minimum Edge User TP of 4.4 Mbps
 - Maximum Dropped FTP DL of 3.6%
- Non-shared: 4 individual operators with traffic X each
 - Macro: $P=43\text{dBm}$, $CF=0.8\text{ GHz}$, $BW=20\text{ MHz}$, $2\times 2\text{ MIMO}$, $ISD = 2500\text{m}$
 - Minimum Edge User TP of 4.2 Mbps
 - Maximum Dropped FTP DL of 4.6%

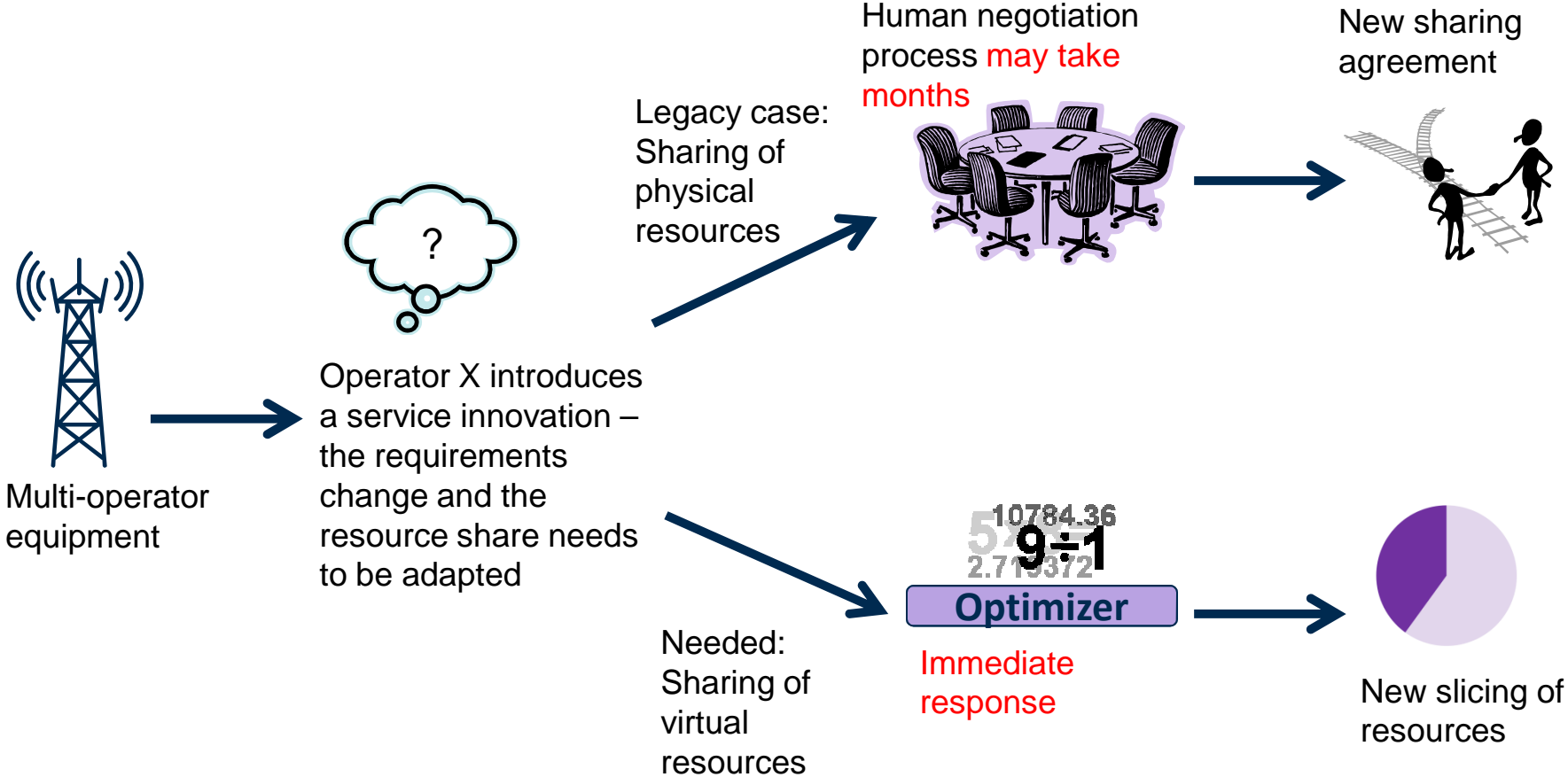


Optimized parameters in blue

Source: A. Ambrosy and M. Wilhelm, Bell Labs, Alcatel-Lucent, unpublished data

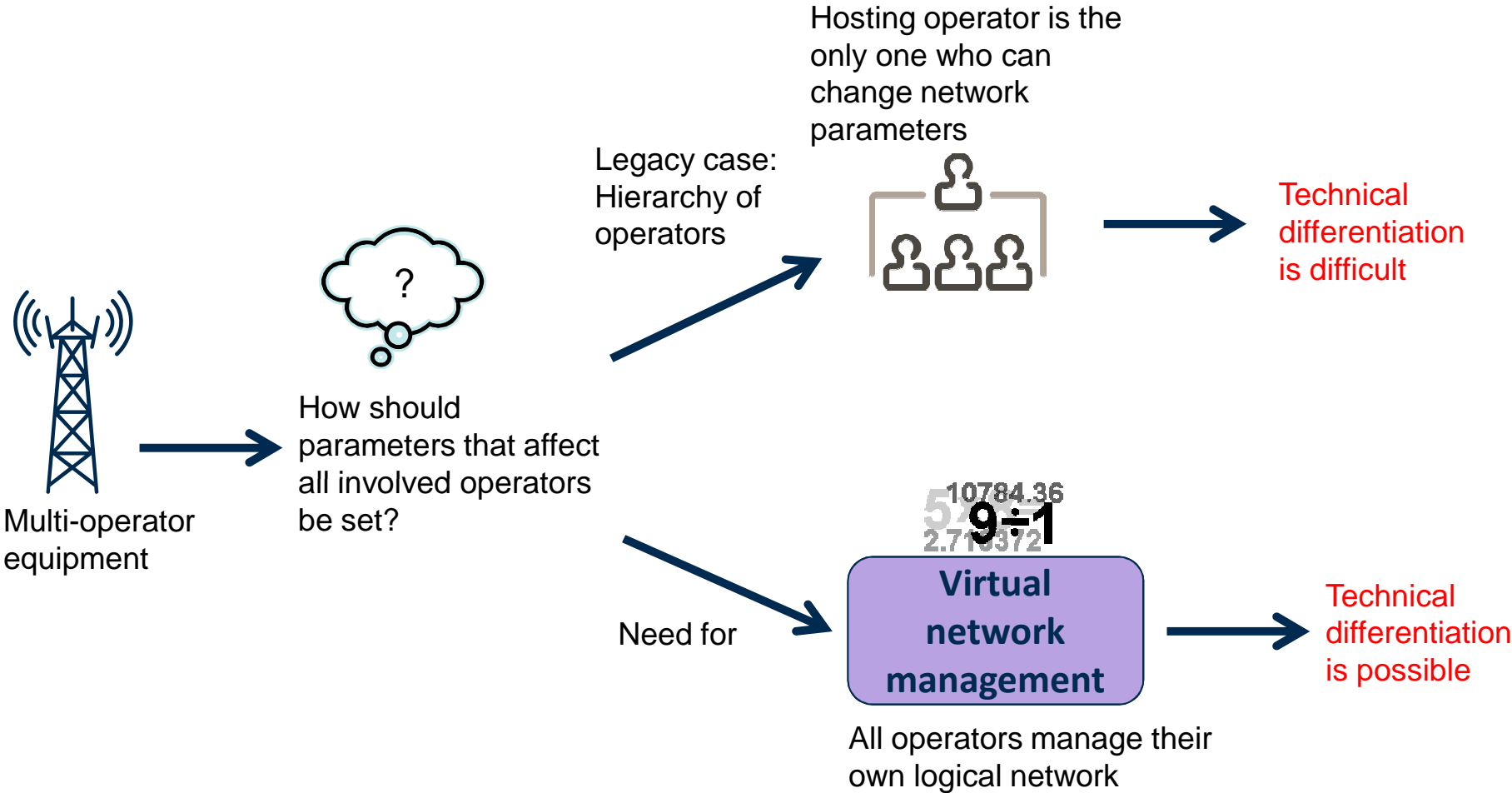
GAINS STRONGLY DEPEND ON ASSUMPTIONS

CHALLENGES - FLEXIBLE SLICING OF RESOURCES



OPERATORS NEED MORE FLEXIBILITY

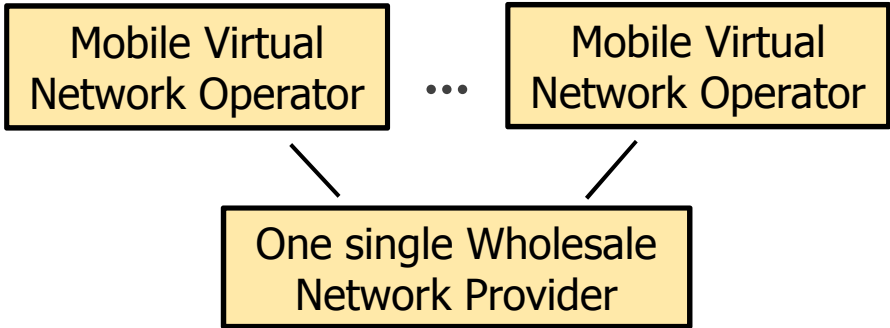
CHALLENGES - NETWORK MANAGEMENT



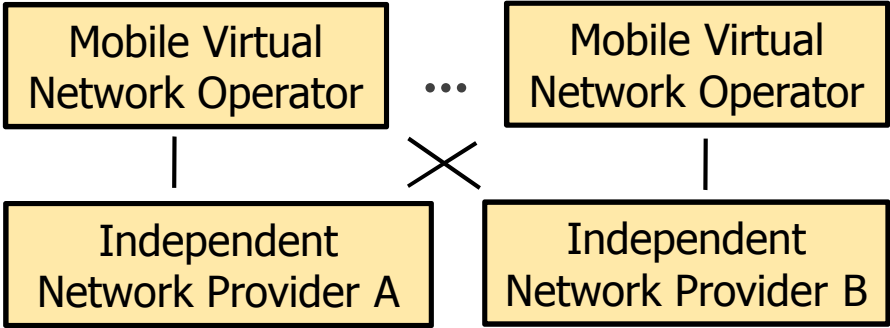
OPERATORS NEED MEANS FOR DIFFERENTIATION

COOPETITION OPTIONS

Wholesale Resources



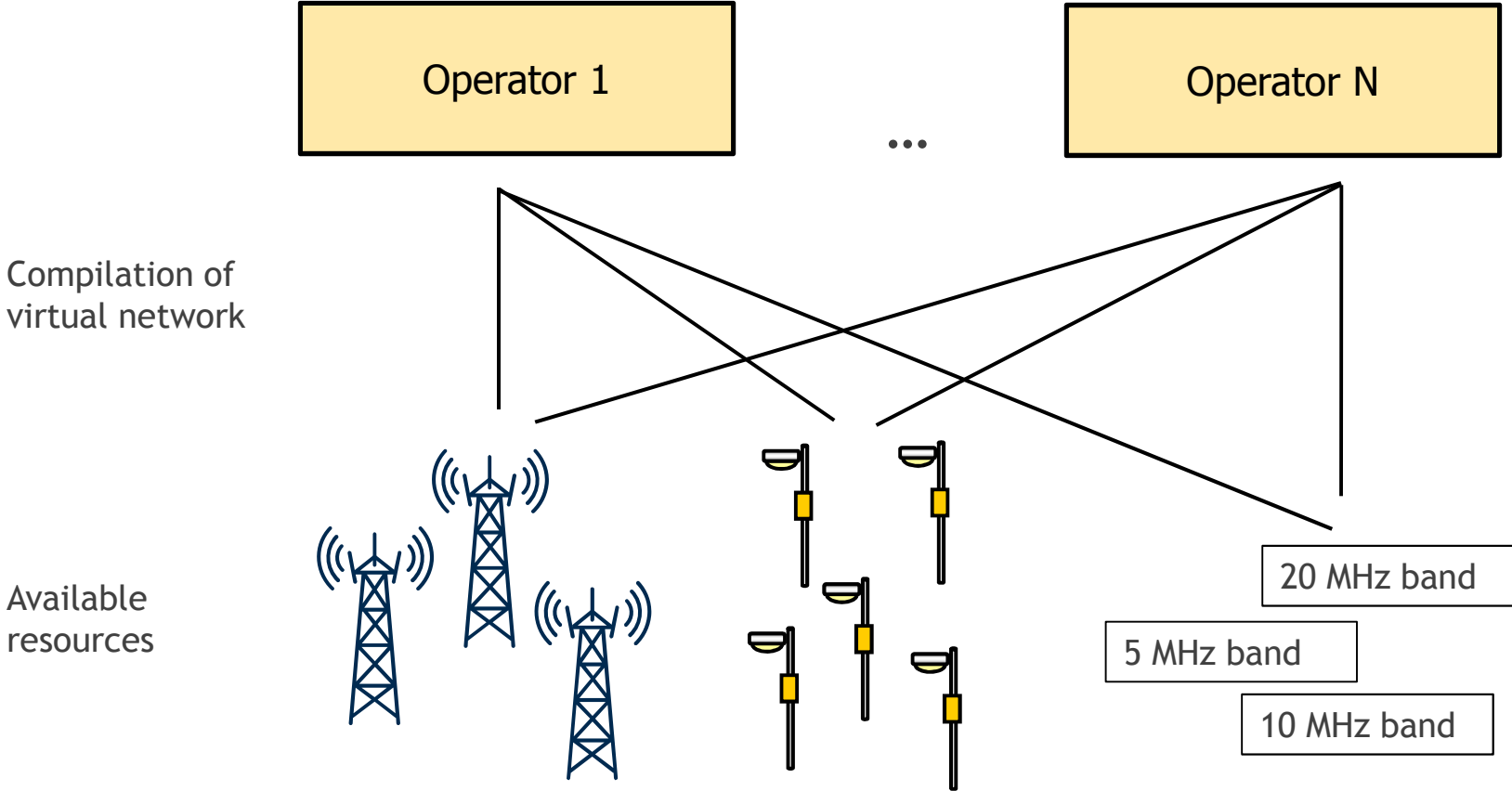
Retail Resources



Further reading:
 - Bell Labs Modeling & Advisory Services, "Open Access LTE", White Paper
 - A. Ghanbari, J. Markendahl, A. A. Widaa, "Regulations for and against cooperation in smallcells: How could regulations stimulate co-opetition by supporting sharing?", 24th European Regional Conference of the International Telecommunication Society, 2013

REGULATORS NEED TO BE INVOLVED IN THE DISCUSSION

TOWARDS A DYNAMIC USE OF SHARED RESOURCES



See also: L. Doyle, J. Kibilda, T. K. Forde, and L. DaSilva, "Spectrum Without Bounds, Networks Without Borders", Proceedings of the IEEE, 102, 3, 2014

EXPLOIT VIRTUALIZATION PRINCIPLES FOR NETWORK SHARING

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